

Index

a

- acoustic resonator 185
- AlAs 92, 93
- AlGaAs 87, 92, 96, 97, 99, 100, 103, 104, 106, 111, 115, 133, 135–137, 141
- Allan variance 23
- anti-bunching of photons 222, 223, 226
- arrays of QHE resistors 108
- avalanche photodiode (APD) 227, 229

b

- band structure 88, 92, 93, 112, 115
- base units 2, 11, 20, 21, 123, 156, 169, 201, 245
- BCS theory 40, 63
- blackbody radiometer 186
- Bloch oscillation 140
- Bordé–Ramsey atom interferometry 203, 212
- bunching of photons 222

c

- calculable capacitor 58, 104, 105, 108, 110, 111
- characteristic frequency 48, 53, 54
- characteristic voltage 48, 49, 51
- chemical potential 102, 125–127, 129, 139
- Clausius–Mossotti relation 183
- clock comparisons 28, 220
- coherence properties of light 220
- conductivity 99
- consensus value 172

constant volume gas thermometer

(CVGT) 182, 183

- Cooper pair 39–44, 63, 66, 100, 123, 139, 140

coordinated universal time (UTC) 12

coplanar waveguide 48

correlation function 220

first-order 220, 221

second-order 221, 222, 224–227

cotunneling 132, 133

Coulomb blockade 124–127, 131, 191
oscillation 127–128

Coulomb energy 126, 127, 132, 133, 137, 191

critical current 42, 45, 48, 51, 67, 68, 70–72, 106, 116, 140

cryogenic current comparator (CCC) 74–76, 107, 143–145

cryogenic radiometer 187

Cs atomic clock 12, 14, 23, 25

Cs fountain clock 23–35

current biasing of SQUID 71

cyclotron frequency 88, 160

d

defining constant of the SI 3, 9–11, 39, 57, 87, 103, 108, 123, 142, 155, 181

density of states 89–91, 99, 101, 114, 139

derived units 11, 20, 21

deterministic single-photon source 223

Dirac point 112, 115

disorder 101

- doping 92, 95–97, 112, 114
 Doppler effect 26, 27, 29, 187, 189,
 203, 210
- e**
 edge channel model 101
 effective electron mass 88, 112
 Einstein's equivalence principle 153,
 218
 electrochemical potential 126
 electron shelving technique 212
 electrostatic potential 126
 energy dispersion 88, 90
 ensemble of reference mass standards
 172
 ephemeris second 2, 11, 12
 Er-doped fiber laser 207
 error accounting 141
 exciton 226, 227
- f**
 filling factor 99–102, 104, 107, 114,
 167
 fine-structure constant 103, 110–111,
 157, 159, 160, 171, 214, 216–218
 Fizeau interferometer 160, 161
 flux-locked loop 72, 228
 flux quantum 6, 21, 39, 42, 43, 53, 54,
 62, 65, 67, 68, 70, 72, 100
 flux transformer 73, 74
 fractional quantum Hall effect 102
 frequency chain 204
 frequency stability 23, 27
- g**
 GaAs 92–97, 106, 111, 112, 116, 117,
 136, 138, 141
 GaAs/AlGaAs heterostructure 93, 100,
 103, 104, 106, 111, 115, 133, 225
 gauge block 13
 General Conference on Weights and
 Measures 1
 guidelines for QHE metrology 103
 Guide to the Expression of Uncertainty
 in Measurement (GUM) 5
 gyromagnetic ratio of the proton 79
- h**
 half-integer quantum Hall effect 115
 Hall
 coefficient 98
 field 98
 resistance 98
 voltage 98
 Hall bar 106–109, 115, 116
 Hanbury Brown and Twiss
 interferometer 221
 Heisenberg uncertainty relation 6, 26,
 125
 heterojunction 92, 93, 96, 101
 highly enriched ^{28}Si 164
 high-temperature superconductors 41,
 47
 hydrogen maser 35
- i**
 impedance bridge 61
 impedance metrology based on the
 QHE 108
 international atomic time (TAI) 12, 35
 international Avogadro coordination
 (IAC) 157, 164
 International Earth Rotation and
 Reference Systems Service
 (IERS) 12
 international kilogram prototype (IKP)
 2, 14, 153, 154, 181
 international temperature scale (ITS)
 17, 194
 ion accumulation experiment 157, 159
 isotope dilution mass spectrometry
 (IDMS) 164
- j**
 Johnson noise thermometry 57, 62,
 189–191
 Josephson arbitrary waveform
 synthesizer 53
 Josephson constant 42, 58, 59, 105,
 106, 142–144, 155, 158, 166, 190
 Josephson equations 42, 45, 68
 Josephson impedances bridge 61
 Josephson junction 41
 overdamped 45, 50, 53

SINIS 45, 47, 50, 52
 SIS 45, 47
 SNS 45, 47, 50, 52, 54
 underdamped 45
 Joule balance 169

k

Kilogramme des Archives 153

l

Lamb–Dicke regime 203, 210, 213
 Landauer–Büttiker formalism 102
 Landau level 89–91, 99, 101, 102, 107,
 111–113, 115
 leap second 12
 linewidth, homogeneous 29
 localized electronic states 101
 London penetration depth 64, 65, 67,
 75

m

magic wavelength 213
 magnetically shielded room 77
 magnetic flux quantization 65
 magnetic moment, measurement of 74
 magnetocardiography 76
 magnetoencephalography 76
 magnetometer 2, 9, 10, 71, 73–74, 77
 magneto-optical trap 28–31
 magnetotransport 87, 114
 McCumber parameter 45, 71
 measurement uncertainty 2, 5–9
 Meissner–Ochsenfeld effect 40,
 63–64, 66, 75

metalorganic chemical vapor deposition
 93

metalorganic vapor phase epitaxy 93
 metal-oxide-semiconductor field-effect
 transistor 87, 92, 137

Meter Convention 1, 58, 59, 104, 105,
 158

Mètre des Archives 1

metrology 1–3, 21, 28, 35, 39, 40, 43,
 47, 50, 52, 57–62, 68, 74, 78, 87,
 92, 93, 99, 103–117, 136, 143

microstrip line 48, 49

mobility of electrons 96, 106, 115

mode locking 205, 207, 208
 molar mass of Si 159, 164
 molar mass unit 157, 159, 170
 molecular beam epitaxy 93

n

neutral atom clocks 211–214
 noise
 1/f 9
 quantum 8–9
 shot 9
 thermal 7–8
 noise power spectral density 7–10
 nomenclature of atomic states 24
 nuclear magnetic resonance 78
 Nyquist relation 7, 39, 189, 225

o

octupole transition 202, 214, 215, 219
 optical lattice clock 213, 214, 246
 optical molasses 28–31

p

Paul trap 209–211, 216
 Penning trap 158, 160, 188, 209
 phase relaxation time 29, 202
 photomultiplier tube 227
 photon-assisted tunneling 132
 Planck law 186, 187
 probabilistic single-photon source 223
 proton-to-electron mass ratio 218, 219
 provisional low temperature scale (PLTS
 2000) 17, 194

q

quantization energy 90, 91, 133
 quantized current 123, 127, 135, 144
 quantized voltage noise source 190
 quantum anomalous Hall effect 104
 quantum-based electric power standard
 60
 quantum dots, self-assembled
 225–227
 quantum interference 2, 9, 39, 66–67,
 69, 70, 140, 228
 quantum jump fluorescence detection
 214

- quantum logic spectroscopy 215
 quantum optics 220
 quantum phase slip 140
 quantum voltmeter 60, 245
 quantum well 90, 91, 94–96, 99
- r**
 Rabi frequency 26
 Ramsey technique 25, 26, 32
 RCSJ model 44, 45, 53, 71
 recoil limit 32
 recoil momentum 29, 203
 resistance bridge 76
 resistivity 98, 99
 R-pump 133, 144, 146
 Rydberg frequency 218
- s**
 saturated absorption spectroscopy 203, 213
 scaling of resistance values 107
 Schrödinger equation 41, 42
 sensitivity factor 218
 Shapiro steps 43–45, 47, 48, 50, 55, 140, 166, 167
 shielded proton gyromagnetic ratio 79
 silicon single crystal 2, 157–159
 single-electron
 electrometer 128
 pump 129, 131–133, 144
 quantum box 124
 shuttle pumping 132, 141, 146
 transistor 125–127
 turnstile 129, 138
 single-ion frequency standards 214
 single-photon emitters 3, 201, 222–224, 226, 229, 230
 SINIS structure 138
 Sisyphus cooling 31
 size quantization 88, 90, 91, 133, 225
 spectral radiance 186
 speed of sound 17, 182, 184, 185
 SQUID 62, 228
 gradiometer
 first-order 73
 second-order 74
- stability diagram
 SET pump 129
 SET transistor 128
 Stefan–Boltzmann law 186
 superconducting magnetic levitation 155, 157
 superconducting quantized charge
 pump 139
 superconducting sluice 140
 superconducting transition-edge sensor 228
 supercontinuum 207, 208
 supercurrent 41, 45, 62, 66, 67, 69
 sympathetic cooling 216
 synchrotron radiation 186, 229, 230
- t**
 thermal converter 50, 60, 61
 thermal state equation 182
 titanium–sapphire laser 206
 total radiance 186
 transfer error 130–133, 135–141, 144, 145
 triple point of water 16, 17, 181, 194
 tunnel element 124, 125, 192
 two-dimensional electron gas 87, 91, 95, 96, 98, 112, 133, 225
- u**
 ultrastable low-noise current amplifier 74, 136, 143
 universality of the QHE 102–104, 115
- v**
 virial expansion 182, 183
 voltage balance 58, 142, 155, 157
 von Klitzing constant 59, 100, 104–106, 110, 111, 125, 142–144, 158, 167, 191
- x**
 x-ray crystal density (XRCD) 157, 158
 x-ray interferometer 162, 163
- z**
 Zeeman energy 89, 107
 Zeeman slower 29

